

1. Assumptions concerning Performance. An underlying reason for the remaining technical dispute is that common carrier point-to-point microwave links are designed to a far more conservative specification than the Hye Crest network. The common carrier specification may be appropriate for long-haul networks with many hops of microwave, carrying voice and data. In contrast, the Hye Crest network is a single hop network carrying video.

For example, SWBT February 28 Comments disagree with the Hye Crest requirement of 8.5 hours per year of below-standard performance. "This is an adequate standard for the public telephone network which is generally designed to keep end-to-end outages to less than 105 minutes per year." Southwestern Bell Comments at p.4. Such a performance level is inappropriate for the Hye Crest video distribution service. Moreover, the 8.5 hours of below-standard performance is not an outage, it is simply a period of slightly more noisy picture quality, where picture quality is reduced from "excellent" to "good."

But in fact, the Southwestern Bell argument proves too much. It proves that the 27.5 - 29.5 GHz band is simply not suitable for telephone company use. The 105 minutes per year outage specification requires a safety factor of 10.3 dB per mile, rather than the 5 dB per mile required by the Hye Crest network. Because of rain outage levels, atmospheric attenuation and because it is not economically efficient to generate the high levels of power needed, a safety factor of 10.3 dB per mile is not economically feasible in this band, except at very short path lengths. The 27.5 - 29.5

GHz band is simply not suitable for use in the public switched telephone network. It is perfectly suitable, however, for the Hye Crest application.

2. Noise Floor. A key element in Hye Crest's technical arguments is that communications systems have a noise floor; signals below this level are not discernible. Potentially interfering signals that are received at levels below the noise floor will not actually cause interference. Curiously, the NSMA response totally ignores this argument.

Even though the noise floor concept is not used in telephone company microwave spectrum calculations, it is an essential part of FCC spectrum management policies. For example, in specifying the maximum permissible interference allowed into a satellite station, the Commission's specification includes the term  $10 \log_{10}(kTB)$ , which is precisely the noise floor of the satellite receiver. Section 25.252, FCC Rules and Regulations.

Bell Atlantic accepts the noise floor analysis but quibbles over whether the appropriate margin below the noise floor should be 3 dB or 6 dB. That difference may be irrelevant, however, since the Hye Crest "forbidden zone" of 660 ft. and 5 degree angle is for an interfering signal which is 15 dB below noise, not 3 dB. See page 5 of the Bossard report "since . . . the noise floor is -116

dBW and the interference is at -131 dBW the signal from the Hye Crest omni transmitter is well below the noise level at A.<sup>4</sup>

Thus, the Hye Crest design has an additional factor of safety of 12 dB.

3. Polarization. We also disagree with the treatment of polarization isolation made in the pleadings opposing grant. Polarization isolation of 30-35 dB can be expected under normal conditions. In very heavy rainfall, depolarization does occur, but at these frequencies the depolarization is always less than the additional attenuation caused by the rainfall. For example, using 30 GHz data<sup>5</sup>, rain depolarization of 12 dB over a 5 mile path would be expected in a 25 mm/hr rain, while the signal attenuation would be 37 dB over that same path length. In other words, rain depolarization will not increase the likelihood of interference.

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<sup>4</sup> -131 dBW + 116 dBW + 3 dB = 12 dB margin.

<sup>5</sup> See, e.g. "Prediction of Cross Polarization Distortion to Rain in 20 GHz Band" K. Morita, Review of Electrical Communication Laboratories, Vol. 24, August 1976; "Cross Polarization at 10 and 30 GHz due to Rain" M. Saunders, IEEE transactions of Antennas and Propagation, Vol. AP 19, March 1971; "Rain Induced Cross-Polarization at Centimeter and Millimeter Wavelengths," T. S. Chu, Bell System Technical Journal, October 1974; and "Rain Depolarization Studies at Centimeter and Millimeter Wavelengths," T. Oguchi, Journal of the Radio Research Laboratories Vol 22 1975.

The reference material offered by Bell Atlantic does not support the conclusions which were claimed by that company for operations at 28 GHz. The foregoing articles, which address germane propagation characteristics at 20 and 30 GHz confirm the analysis of Hye Crest with respect to these matters.

Also we disagree with the Bell Atlantic assumption that oscillators must be coherent in order to achieve cross-polarization isolation. Bell Atlantic Comments at p. 5. This is simply not true in general.

Cross-polarization isolation between different, non-coherent transmitters is a commonly-used spectrum management technique. Indeed, the Commission has placed its reliance on cross-polarization between adjacent satellites in order to achieve 2 degree orbital spacing. See Notice of Proposed Rulemaking in CC Docket No. 86-496, 2 FCC Rcd 762, at para. 22.

4. Reflected Signals We disagree with the Bell Atlantic assumption that reflections off buildings will be a substantial source of interference. Bell Atlantic Comments at p. 4. At these frequencies, beamwidths are very narrow, even for fairly small antennas, and reflected signals that enter the antenna even a few degrees off the main axis will be greatly suppressed.

5. Receive Antenna Performance. Contrary to the suggestion in NSMA's pleading (pp 5-6), the fact that cross-polarization isolation is not a constant value at all angles does not undercut Hye Crest's conclusions that frequency sharing can be achieved. We attach information regarding receive antennas to be supplied by a manufacturer that shows: (1) antennas available in this frequency range exhibit substantial isolation with respect to undesired signals entering at angles off the main beam; and (2) substantial

isolation with respect to signals of the opposite polarization can be achieved. For example, the attached letter of Seavey Engineering and Associates, Inc. (Attachment A hereto) confirms that 50 dB suppression of cross-polarization starting at 5° from boresight is achievable with a 40" dish reflector and that very good levels of isolation are achievable with a 24" dish. In this connection, our conclusions about frequency sharing are still valid because of the 12 dB margin in Hye Crest's system. See our discussion in Section 2 above.

\* \* \*

From the foregoing, it is apparent that the objections to grant offered in this proceeding fail to provide any substantial basis for depriving the public of the benefits of new competitive communications services and of the capabilities of newly developed 28 GHz technology. The remaining areas of technical dispute are tangential to one fundamental consideration which is effectively undisputed, that grant of Hye Crest's application will not deprive any party here of 28 GHz spectrum for which such party has a demonstrated need or even the transmit/receive facilities to implement. The parties opposing grant ultimately bear the burden of persuading the Commission that the inauguration of Hye Crest's competitive services and the rapid implementation of its new

technologies should be denied. This they have failed to do. The Commission should now grant the above-captioned application.

Respectfully submitted,

HYE CREST MANAGEMENT, INC.

/s/ George Y. Wheeler  
George Y. Wheeler  
Koteen & Naftalin  
Suite 1000  
1150 Connecticut Avenue, N.W.  
Washington, D.C. 20036  
(202) 467-5700

Its Attorney

# SEAVEY ENGINEERING ASSOCIATES, INC.

## ANTENNA DESIGN AND DEVELOPMENT

March 24, 198

Mr. Bernard Bossard  
685 Center Street  
Norwood, MA 02062

Subject: 28 GHz Antenna Radiation Patterns  
Reference: Recent Telecons

Dear Bernie:

Enclosed is a Radiation Pattern Envelope describing a 24-inch diameter shrouded, RF absorber-lined, scalar horn fed, teflon radome-covered antenna operating in the 27.5-29.5 GHz frequency band.

This antenna exhibits exceptional sidelobe suppression.

In particular, the cross-polarization 5° from the main beam is 46 dB down from the co-pol peak.

You may wish to consider this antenna for those installations requiring extremely tight control of sidelobes.

If your requirement is for -50 dB suppression of the cross-polarization starting at 5° from boresight, this may be achieved. In this case, the reflector size would grow to about 40 inches diameter. With this larger series of antennas, the beamwidths will narrow to about 1° or so with resulting requirements for close tolerance pointing.

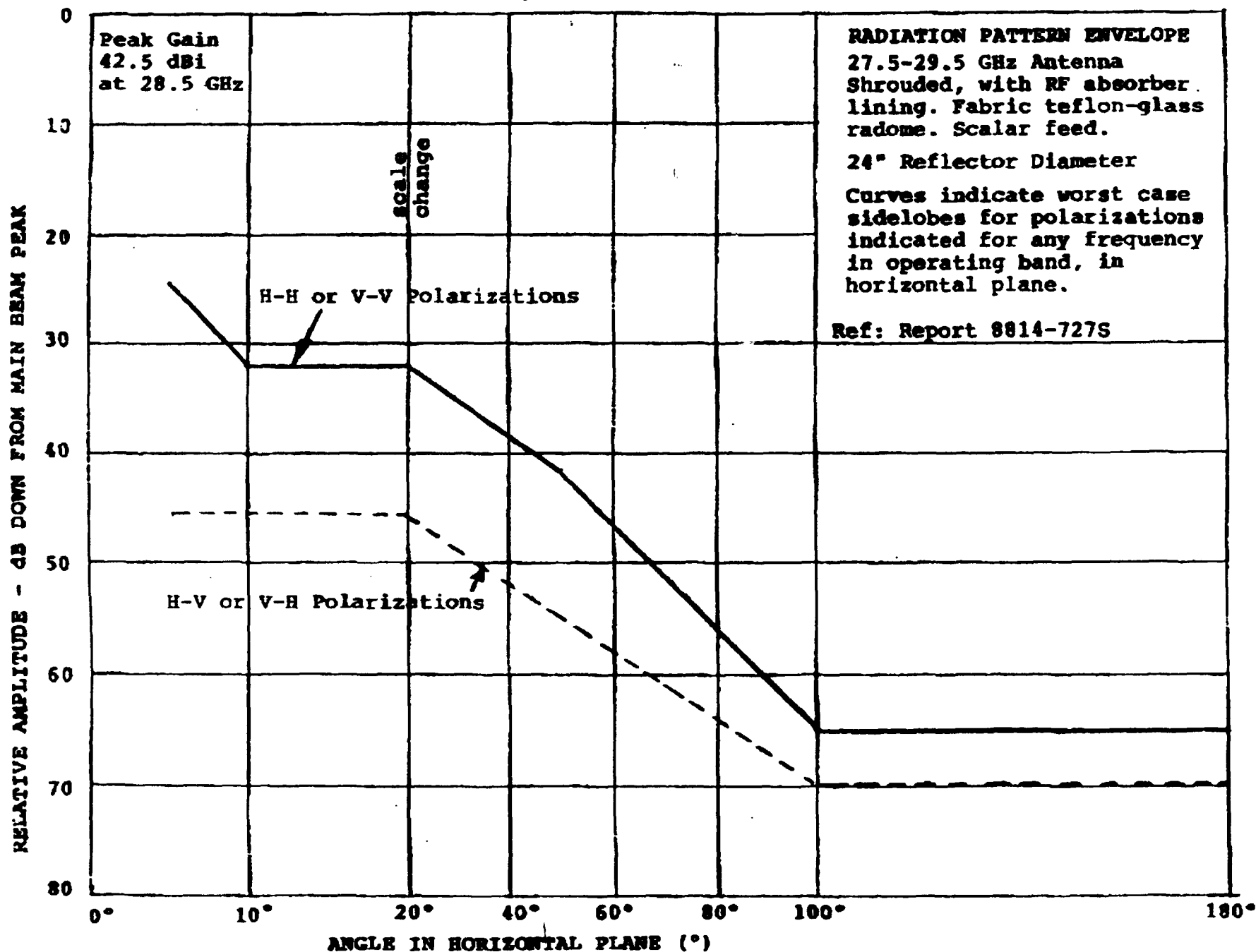
I trust that this information is helpful.

Sincerely,

  
John M. Seavey  
President

JMS:yes

enc: RPE





MARCH 22, 1989

AFFIDAVIT OF ROGER L. FREEMAN

I, Roger L. Freeman, being duly sworn, do depose and state as follows:

1. I am a Telecommunication System Engineer specializing in microwave system analysis, design, implementation and integration. I am retained by Hye Crest Management, Inc. Additional information regarding my technical background is shown in Attachment A hereto.

2. I am familiar with the engineering response made by Hye Crest Management, Inc on March 24. Such statements are true, complete and correct to my personal knowledge.

3. I have carried out an analysis and critique of the Technical Report prepared by Joseph F. White and Bernard B. Bossard of the Response of Hye Crest Management, Inc. in file No. 10380-CF-P-88. Except for those factual matters of which are public record and those of which are indicated, the statements made in that engineering exhibit are true, complete and correct to my personal knowledge.

DATE: Mar 24, 1989

Roger L. Freeman  
Roger L. Freeman

Subscribed and sworn before me this 24<sup>th</sup> day of March 1989.

Joseph J. Kirk  
Notary Public

My Commission Expires May 29, 1992

My commission expires: \_\_\_\_\_



Original Affidavit will be filed as soon as possible.

**ATTACHMENT A**

to affidavit of Roger L. Freeman  
of March 22, 1989

The following is a supplement to the affidavit of Roger L. Freeman, 77 Cider Mill Road, Sudbury, MA 01776; Telephone 508-443-6949.

I have 43 years experience in telecommunications: operations, system engineering and network design. I specialize in radio systems.

I hold bachelors and masters degrees from New York University, am a senior member of the IEEE and candidate for fellow (1989). I teach telecommunication system engineering courses at Northeastern University including RADIO SYSTEM DESIGN FOR TELECOMMUNICATIONS (1-100 GHz), based on a text with the same title published by John Wiley & Sons, NY 1987, which I am the author.

John Wiley & Sons, New York has published three other technical books of mine: REFERENCE MANUAL FOR TELECOMMUNICATION ENGINEERING, TELECOMMUNICATION TRANSMISSION HANDBOOK (2nd ed) and TELECOMMUNICATION SYSTEM ENGINEERING (2nd ed 3rd quarter 1989).

I hold two FCC licenses: General Radiotelephone and First Class Telegraph. I have a long background with the ITU (CCIR/CCITT) dating back to 1967 when I was regional planning expert for northern South America based in Quito, Ecuador.

I was Conference Chairman for the SPIE convention in Boston, Sept 1988 and their keynote speaker. I am a session chairman for IEEE MILCOM 89, also to be held in the Boston area. I was Secretary of the Spain Section of the IEEE from 1975 to 1978. I have designed and built earth stations, line-of-sight microwave systems and troposcatter systems for ITT, Page Communications Engineers (now CONTEL Federal Systems), and Jerrold Electronic Corporation. I have been responsible for operation, maintenance and overhaul of line-of-sight microwave systems when I was a senior field engineer with Bendix Radio Company.

**CERTIFICATE OF SERVICE**

I, Jennifer Garcia, a secretary in the law firm of Koteen & Naftalin, do hereby certify that copies of the foregoing "RESPONSE OF HYE CREST MANAGEMENT, INC.," with attachments, were mailed first-class U.S. Mail, this 24th day of March, 1989 to the following:

\*Gerald Brock, Chief  
Common Carrier Bureau  
Federal Communications Commission  
1919 M Street, N.W.  
Room 500  
Washington, D.C. 20554

\*James R. Keegan, Esq.  
Chief, Domestic Facilities Division  
Common Carrier Bureau  
Federal Communications Commission  
2025 M Street, N.W.  
Room 6010  
Washington, D.C. 20544

\*Mr. Frank Peace, Jr.  
Common Carrier Bureau  
Federal Communications Commission  
2025 M Street, N.W.  
Room 6310  
Washington, D.C. 20554

William B. Barfield, Esq.  
BellSouth Corporation  
1155 Peachtree Street, N.E.  
Suite 1800  
Atlanta, GA 30367-6000

Thomas L. Welch, Esq.  
The Bell Atlantic Telephone Companies  
1710 H Street, N.W.  
Washington, D.C. 20006

John D. Pellegrin, Esq.  
Pellegrin & Levine, Chartered  
1140 Connecticut Avenue, N.W.  
Suite 312  
Washington, D.C. 20036  
Counsel for National Spectrum  
Managers Association, Inc.

Dana A. Rasmussen, Esq.  
The Mountain States Telephone and  
Telegraph Company  
1020 19th Street, N.W.  
Suite 700  
Washington, D.C. 20036

Mary McDermott, Esq.  
NYNEX Telephone Companies  
120 Bloomingdale Road  
White Plains, NY 10605

William C. Sullivan, Esq.  
Southwestern Bell Telephone Company  
1010 Pine Street  
Room 2305  
St. Louis, MO 63101

International Transcription  
Services, Inc.  
2100 M Street, N.W.  
Suite 140  
Washington, D.C. 20037

/s/ Jennifer Garcia  
Jennifer Garcia

\* Hand Delivered